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A. F. POWER METER

TYPE 1585

ISSUE 2

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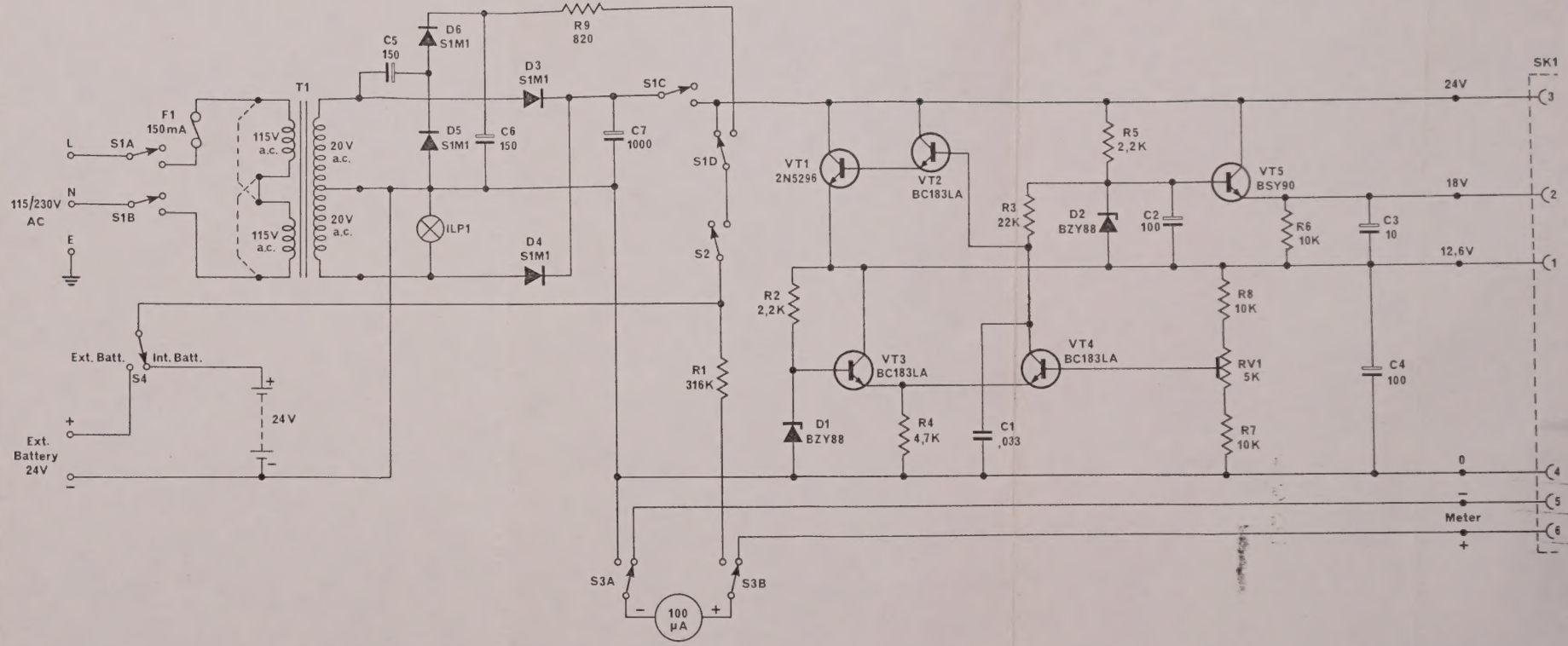
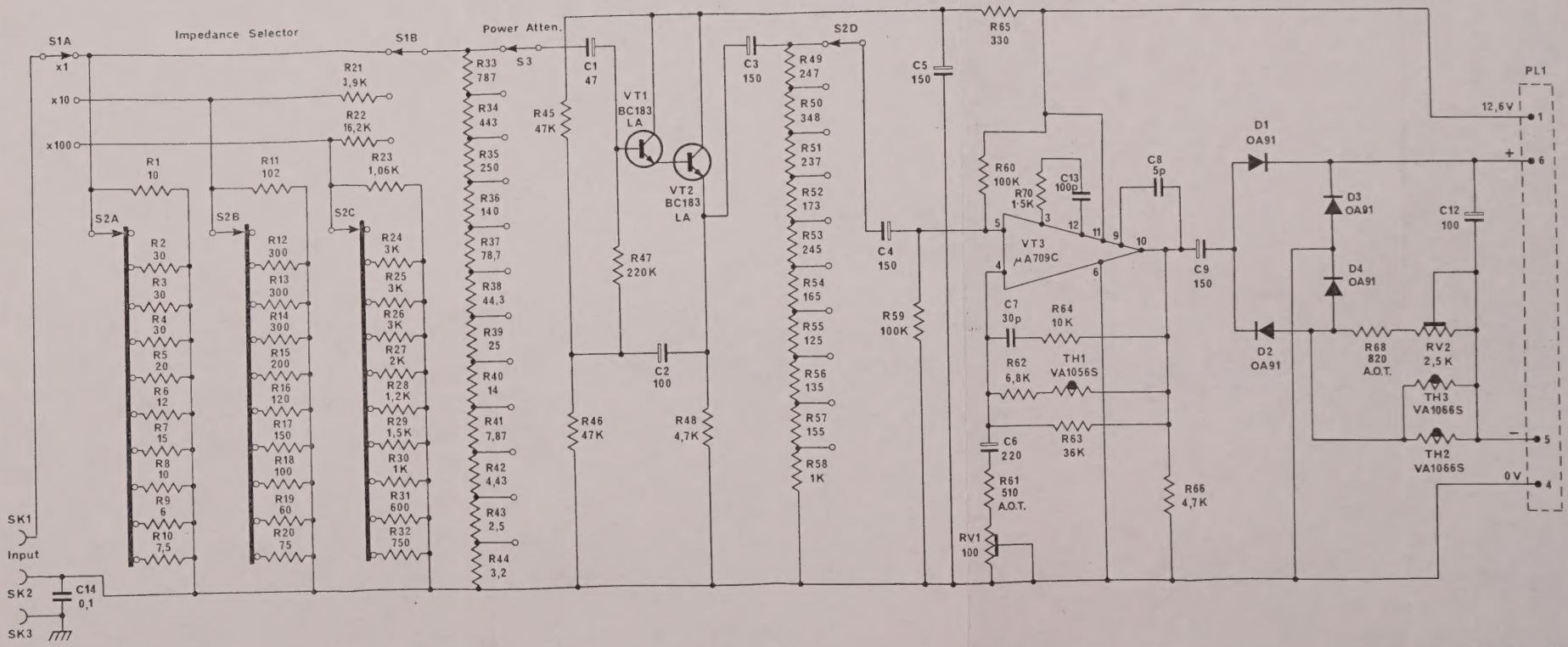
A. F. Power Meter
Type 1585



Power Supply

A2-101602-1



A.F. Power Meter Type 1585

A2-101625-06

1. GENERAL DESCRIPTION.

The Dymar Audio Frequency Power Meter Type 1585 has been designed to provide wide power measuring range, wide frequency response and high accuracy both of the terminating impedance and measured power. It is operated either from A. C. Mains or from its own rechargeable battery and as such it is equally suitable as a laboratory instrument or as portable field servicing equipment.

Twelve power ranges in 1-3-10 sequence give full scale readings of 100μ W to 30 Watts on a 5 inch precision mirror-backed meter. An auxilliary db scale allows direct readings in decibels relative to 1 m Watt from -20 dbm to +45 dbm.

A feature of the instrument is a temperature compensated "square law" detector which gives true power readings and makes the meter scale sensibly linear. This is particularly useful in signal/noise measurements where the noise power can be accurately determined.

There is a choice of 30 input impedances arranged in three decades from 1.25Ω to 1000 each one accurate to 2% and capable of dissipating 50 Watts continuously. All the most common impedance values are available and the wide choice of low impedance inputs makes this instrument particularly useful for testing modern high power transistorised amplifiers.

2. SPECIFICATION.

Power Range	100 μW f.s.d. to 30 Watts in 12 ranges of 1-3-10 sequence.
Accuracy	At any frequency between 100 Hz and 10 kHz the power measurement accuracy is 3%.
Bandwidth	In the frequency ranges 30 Hz to 100 Hz and 10 kHz to 30 kHz there is an additional error of -0.3 db due to frequency roll-off.
Input Impedance	30 values from 1.25 to 1000Ω as follows: 1.25, 1.5, 2, 2.5, 3, 4, 5, 6, 7.5 and 10 with multipliers of x 10 and x 100.
Impedance Accuracy	2% at any setting and at any frequency from D.C. to 30 kHz.
External Power Supply	190 to 260 Volts 95 to 130 Volts 50 - 60 Hz or 22 to 32 Volts DC at 10mA
Internal Battery	24 Volt (nominal) Nickel Cadmium rechargeable battery of 400 mAh capacity giving a typical operating time of 40 hours between recharging.

Internal Battery (Cont'd)	Batteries can be recharged internally through a built in charging circuit in 14 hours from a fully discharged condition (22 volts).
Meter	Precision 5 inch movement with mirror backed scale calibrated 0-10, 0-3 and a db scale of -5 to +5 dbm. A "Check Battery" push button connects the meter across the battery to read voltage directly.

Dimensions and Weight

Width	Height	Depth	Weight
$16\frac{1}{2}$"	$6\frac{1}{2}$"	8"	13 lbs.
42cm	16.5cm	20cm	6 kg.

Accessories	Rack Mounting Adaptor Kit Type 1801 Protective Front Panel Cover Type 1802

3. OPERATION.

3.1 Power Supply

The instrument as despatched from the factory is normally set for 230 V operation and no further tap changes or adjustments are necessary provided the mains voltage is between 190 and 260 Volts A. C. If the mains voltage is in the range 95 to 130 Volts A. C. then the primary windings on the transformer have to be connected in parallel and not in series. In order to do this remove the cover from the instrument and make the following adjustments on the power supply board which is situated behind the meter. Remove the link which connects the two pins marked 230V and substitute it with two links across pins marked 115 V. Also replace the 150 mA fuse with an equivalent type but rated for 300 mA.

To operate the instrument from the mains supply push the red button marked "Mains" which will then light up.

To operate the instrument from its own internal battery first check the battery voltage by depressing the green button when a reading of not less than 22 Volt on the 30 Volt scale should be obtained, and then push in the blue button only. This button does not light up in the interest of conserving battery drain but the instrument is nevertheless operational. If the battery voltage is less than 22 Volts the batteries need re-charging. This is done by depressing both red and blue buttons, when the instrument is operational from the mains and charging its own batteries simultaneously. A discharged battery of 22 Volts or less will take 14 hours of charging to obtain its full charge.

To operate the instrument from an external battery connect it to the two sockets at the back and push the slider switch to "External battery" and then proceed as before. The battery should have a nominal voltage of 24 Volts and the instrument will operate satisfactorily between 22 and 32 Volts D.C.

3.2. Power Measurement.

Apply the signal to be measured to the input terminals which are "floating" with respect to chassis. For unbalanced signals the red terminal is considered as "Live" and the black terminal can be strapped to the earth terminal if desired. The impedance as presented at the input terminals is resistive over the whole frequency range of the instrument and at DC and therefore care must be taken not to apply signals with a direct current component as this DC power would be dissipated in the instrument but giving no reading on the meter.

Impedance selection is made by the 10 position rotary switch in conjunction with the 3 position push button switch. Thus to set the instrument for a terminal impedance of 600Ω, the selector switch should be set to 6 and the Impedance Multiplier to x 100.

The "Power" range switch is then set to give a convenient reading on the meter. Overloads of up to 50 Watt can be applied without damaging the instrument even if accidentally set to the most sensitive range of 100μ Watts.

3.3. Measurement of Source Impedance

To measure the internal impedance of the signal source, connect as for normal power

measurement and adjust the two "Impedance" controls for maximum indication on the meter. The impedance of the source is then approximately the same as that indicated by the setting of the controls.

4. TECHNICAL DESCRIPTION.

The A.F. Power Meter measures the power delivered by an audio frequency source into a load provided by the instrument itself.

The load consists of 30 semi-precision, wire-wound resistors arranged into three groups corresponding to the three positions of the "Impedance Multiplier" switch S1. Each group contains ten resistors, nine of which are capable of being connected in parallel with the high power, metal clad one, by means of the "Impedance Ω" switch S2. From the impedance attenuator the signal is applied to "Power Attenuator" S3 and further to the double emitter follower VT1 and VT2. S2D is the voltage attenuator section of the "Impedance Ω "switch. The purpose of it is to select the appropriate voltage which corresponds to the given impedance. From the voltage attenuator the signal is fed into the integrated circuit amplifier VT3 and further applied to the rectifying diodes D1, D2, D3 and D4 whose D.C. output is a square law function of the A.C. input. The rectified current drives directly the Meter M1, through pins 5 and 6 of PL1 and SK1.

The design of the power supply is conventional and consists of transformer T_1 and rectifying diodes D_3 and D_4 giving "raw" D.C. across capacitor C_7. This voltage is an unregulated 24 volts and is applied to the regulator which gives a highly stable voltage of 12.6V at pin 1 of S.K.1. The reference voltage is the Zener Diode D1 and the difference amplifier is VT_3 and VT_4. RV1 adjust the voltage to 12.6 Volts precisely. The series element of the regulator is VT1 driven by the emitter follower VT2. The collector load of VT4 is returned to a stabilised

voltage of about 18V (5.6 V relative to 12.6V) from across Zener Diode D2, and this voltage is applied to series transistor VT5 giving a partially stabilised voltage of 18 Volts at pin 2.

The same regulator is used to stabilise the voltage of the internal (or external) battery of 24 Volts.

The internal battery is re-charged by the voltage doubling circuit of D5, D6, C_5 and C_6 through resistor R9.

5. ALIGNMENT PROCEDURE

5.1 If re-alignment of the instrument is required withdraw the right-hand or "Plug-In" part of it, by releasing the two Phillips type screws on the back panel. All test points and pre-set controls are now accessible for adjustment. Do not adjust or tamper with these controls unless adequate test gear is available for the proper calibration of the instrument.

5.2 The following test gear are required.

1) Impedance Bridge or Digital Ohmmeter having 0.2% accuracy.

2) DC/AC Digital Voltmeter preferably of the "True RMS" type with 0.2% accuracy.

3) Audio Frequency source 30 Hz to 30 kHz.

5.3 To check accuracy of input impedance.

Connect the Impedance Bridge (or Ohmmeter) to the input terminals and check that all 30 impedances are within 2% of their nominal values.

5.4 To check the frequency response.

Using an Audio Signal Generator, select a convenient input signal level and check that the frequency response is as specified under paragraph 2.

5.5 To check the "Power" attenuator and the impedance voltage attenuator S2D.

Disconnect from the "Impedance Multiplier" switch all three groups of impedance loads R1

to R10, R11 to R20 and R23 to R32. Connect the A F Signal Generator to the input of the Power Meter and monitor the signal level using the Digital Voltmeter. For some convenient setting of the impedance calculate the voltages required for all positions of the "Power" attenuator and check that the readings are within ± 1%. To check the voltage attenuator S2D, select some convenient position of the "Power" switch, calculate the voltages required for all positions of the "Impedance Ω " switch for "XI " position of the "Impedance Multiplier" switch and check that the readings are within 1%.

To check R21 and R22 apply appropriate voltage and operate "Impedance Multiplier" x 10 and x 100 respectively. The readings should be accurate within 1%.

5. 6 To calibrate the Power Meter.

Set the input impedance of the instrument to 100Ω and the "Power" switch S3 to 0. 1 mW range. Apply from the A. F. Signal Generator to the input sockets of the instrument a sinewave of 0. 1V RMS at about 1 kHz. The input signal level should be monitored to within 0. 2% by means of a Digital Voltmeter. Using the pre-set potentiometer RV2, set the reading of the meter to full scale deflection, if necessary.

Turn the "Power" switch to 1 mW position and by means of the preset RV1 set the reading of the meter to 0. 1 mW on that range. Turn the "Power" switch back to 0. 1 mW range and check that it still is full scale deflection, and if necessary correct accordingly with RV2.

6. COMPONENTS LIST

NOTE: All resistors are in ohms, and all capacitors are in μF, unless otherwise stated.

Circuit Ref.	Description	Value	Tol. %	Rating
6.1 Resistors				
R1	Wirewound	10	2	50W
R2	Wirewound	30	2	13W
R3	Wirewound	30	2	13W
R4	Wirewound	30	2	13W
R5	Wirewound	20	2	13W
R6	Wirewound	12	2	13W
R7	Wirewound	15	2	13W
R8	Wirewound	10	2	13W
R9	Wirewound	6	2	13W
R10	Wirewound	7.5	2	13W
R11	Wirewound	102	2	50W
R12	Wirewound	300	2	13W
R13	Wirewound	300	2	13W
R14	Wirewound	300	2	13W
R15	Wirewound	200	2	13W
R16	Wirewound	120	2	13W
R17	Wirewound	150	2	13W
R18	Wirewound	100	2	13W
R19	Wirewound	60	2	13W
R20	Wirewound	75	2	13W
R21	Metal Film	3.9k	$\frac{1}{2}$	$\frac{1}{4}$W

Circuit Ref.	Description	Value	Tol. %	Rating
R22	Metal Film	16.2k	$\frac{1}{2}$	$\frac{1}{4}$W
R23	Wirewound	1.06k	2	50W
R24	Wirewound	3k	2	13W
R25	Wirewound	3k	2	13W
R26	Wirewound	3k	2	13W
R27	Wirewound	2k	2	13W
R28	Wirewound	1.2k	2	13W
R29	Wirewound	1.5k	2	13W
R30	Wirewound	1k	2	13W
R31	Wirewound	600	2	13W
R32	Wirewound	750	2	13W
R33	Metal Film	787	$\frac{1}{2}$	$\frac{1}{4}$W
R34	Metal Film	443	$\frac{1}{2}$	$\frac{1}{4}$W
R35	Metal Film	250	$\frac{1}{2}$	$\frac{1}{4}$W
R36	Metal Film	140	$\frac{1}{2}$	$\frac{1}{4}$W
R37	Metal Film	78.7	$\frac{1}{2}$	$\frac{1}{4}$W
R38	Metal Film	44.3	$\frac{1}{2}$	$\frac{1}{4}$W
R39	Metal Film	25	$\frac{1}{2}$	$\frac{1}{4}$W
R40	Metal Film	14	$\frac{1}{2}$	$\frac{1}{4}$W
R41	Metal Film	7.87	$\frac{1}{2}$	$\frac{1}{4}$W
R42	Metal Film	4.43	$\frac{1}{2}$	$\frac{1}{4}$W
R43	Metal Film	2.5	$\frac{1}{2}$	$\frac{1}{4}$W
R44	Metal Film	3.2	$\frac{1}{2}$	$\frac{1}{4}$W
R45	Carbon Film	47k	5	$\frac{1}{2}$W
R46	Carbon Film	47k	5	$\frac{1}{2}$W

Circuit Ref	Description	Value	Tol. %	Rating
R47	Carbon Film	220k	5	$\frac{1}{2}$W
R48	Carbon Film	4.7k	5	$\frac{1}{2}$W
R49	Metal Film	247	$\frac{1}{2}$	$\frac{1}{4}$W
R50	Metal Film	348	$\frac{1}{2}$	$\frac{1}{4}$W
R51	Metal Film	237	$\frac{1}{2}$	$\frac{1}{4}$W
R52	Metal Film	173	$\frac{1}{2}$	$\frac{1}{4}$W
R53	Metal Film	245	$\frac{1}{2}$	$\frac{1}{4}$W
R54	Metal Film	165	$\frac{1}{2}$	$\frac{1}{4}$W
R55	Metal Film	125	$\frac{1}{2}$	$\frac{1}{4}$W
R56	Metal Film	135	$\frac{1}{2}$	$\frac{1}{4}$W
R57	Metal Film	155	$\frac{1}{2}$	$\frac{1}{4}$W
R58	Metal Film	1k	$\frac{1}{2}$	$\frac{1}{4}$W
R59	Carbon Film	100k	5	$\frac{1}{2}$W
R60	Carbon Film	100k	5	$\frac{1}{2}$W
R61	Metal Film	510	1	$\frac{1}{4}$W
R62	Metal Film	6.8k	1	$\frac{1}{4}$W
R63	Metal Film	36k	1	$\frac{1}{4}$W
R64	Metal Film	10k	1	$\frac{1}{4}$W
R65	Carbon Film	330	5	$\frac{1}{2}$W
R66	Carbon Film	4.7k	5	$\frac{1}{2}$W
R67	Not used			
R68	Metal Film	820	1	$\frac{1}{4}$W
R69	Not used			
R70	Carbon Film	1.5k	5	$\frac{1}{2}$W

Circuit Ref.	Description	Value	Tol. %	Rating
6.2 Capacitors				
C1	Electrolytic	47		25V
C2	Electrolytic	100		6.4V
C3	Electrolytic	150		16V
C4	Electrolytic	150		16V
C5	Electrolytic	150		16V
C6	Electrolytic	200		10V
C7	Polystyrene	30p		125V
C8	Ceramic	5p		200V
C9	Electrolytic	125		16V
C10	Not used			
C11	Not used			
C12	Electrolytic	100		3V
C13	Ceramic	100		200V
C14	Polyester	0.1		400V
6.3 Semiconductors				
VT1	Texas	BC183LA		
VT2	Texas	BC183LA		
VT3	Fairchild	μA 709C		
D1	Mullard	OA91		
D2	Mullard	OA91		
D3	Mullard	OA91		
D4	Mullard	OA91		

Circuit Ref.	Description	Value	Tol. %	Rating
6.4 Variable Resistors				
RV1	Preset	100		
RV2	Preset	2.5k		
6.5 Miscellaneous				
SK1	Terminal	Belling-Lee		1568/Red
SK2	Terminal	Belling-Lee		1568/Black
SK3	Terminal	Belling-Lee		1568/Black
PL1	Plug	McMurdo		PP6
S1	Switch	Push Button		
S2	Switch	Dymar Drg. No. BD1690		
S3	Switch	Dymar Drg. No. BD1691		
TH1	Thermistor	Mullard VA 1056S		
TH2	Thermistor	Mullard VA 1066S		
TH3	Thermistor	Mullard VA 1066S		
6.6 Power Supply Components				
R1	Metal Oxide	316k	1	½W
R2	Carbon	2.2k	10	½W
R3	Carbon	22k	10	½W
R4	Carbon	4.7k	10	½W
R5	Carbon	2.2k	10	½W
R6	Carbon	10k	10	½W
R7	Carbon	10k	10	½W
R8	Carbon	10k	10	½W
R9	Metal Oxide	820	5	10W

Circuit Ref.	Description	Value	Tol. %	Rating
RV1	Preset	5k		
C1	Ceramic	.033		25V
C2	Electrolytic	100		25V
C3	Electrolytic	10		16V
C4	Electrolytic	100		40V
C5	Electrolytic	150		100V
C6	Electrolytic	150		100V
C7	Electrolytic	1000		40V
VT1	RCA	2N 5296		
VT2	Texas	BC 183LA		
VT3	Texas	BC 183LA		
VT4	Texas	BC 183LA		
VT5	RCA	BSY 90		
D1	Mullard	BZY 88-C6V2		
D2	Mullard	BZY 88-C6V2		
D3	Westinghouse	S1M1		
D4	Westinghouse	S1M1		
D5	Westinghouse	S1M1		
D6	Westinghouse	S1M1		
T1	Transformer	40/1024		
F1	Fuse	Type F268 150mA		
S1	Combined Push-button Switch Special			
S2	Combined Push-button Switch special			

Circuit Ref.	Description	Value	Tol.%	Rating
S3	Combined Push-button Switch Special			
S4	Slider Switch	D.P.D.T.		
	Diamond H	Type 278		
SK1	Socket	McMurdo PS6		